lake, had been fixed by a mortise and tenon arrangement into split trunks, lying horizontally on the bottom of the lake, evidently when the mud was more than usually soft.

Another form of these ancient habitations has been designated fascine dwellings. Instead of a platform supported on a series of piles, Dr. Keller tells us these erections consisted of layers of sticks, or small stems of trees built up from the bottom of the lake, till the structure reached above the water-mark, and on this series of layers the main platform for the huts were placed. In these dwellings upright posts were used as stays or guides for the great mass of sticks reaching down to the bottom of the lake. Fascine dwellings occur chiefly in the smaller lakes, and belong to the stone age.

Another form of lake-dwelling which has been long known, are the Crannoges or "wooden islands," found in Ireland and Scotland; one has also been found in North Wales. "The crannoges, at least in Ireland, were frequently but not exclusively placed on natural islands, or on shallows which approached to this character; sometimes they were built up from the bottom of the lake on the soft mud, exactly in the manner of the fascine dwellings of Switzerland. They are surrounded by a stockade of piles driven into the bed of the lake, so as to inclose either a circle or an oval; the diameter varies from 60 to 130 feet. These piles are usually in a single row, but sometimes the rows are double and even treble. Occasionally the piles are boards, not round stems. The lowest bed within this inclosure is commonly a mass of ferns, branches, and other vegetable matter, generally covered over with a layer of round logs, cut into lengths of from four to six feet, over which is usually found a quantity of clay, gravel, and stones." Although it is probable that both these crannoges and the Swiss lake-dwellings, which it will be seen had much in common with regard to structure, were erected in lakes greatly for the sake of security, still the lake-dwellings were evidently places of permanent habitation, while the Scotch crannoges, at least, are believed by good authorities to have been chieftains' forts and fastnesses for occasional retreat. The crannoges were actually used far into the age of iron, while the Swiss lake-dwellings belong almost exclusively to the age of stone, and disappeared, Dr. Keller tells us, as far as we at present know, about the first century.

With regard to the superstructure of these pile-dwellings, it appears that on the platform was laid and beaten down firmly a bed of mud, loam, and gravel. The framework of the huts consisted of small piles or stakes, and sometimes of the upper or projecting parts of piles, longer than those on which the platform was built. Round the bottom, at least, of the hut a board or skirting was fitted, and the walls or sides were in a great measure made of a wattle or hurdle-work of small branches, woven in between the upright piles, and covered with a considerable thickness of loam or clay. The huts seem in nearly all cases to have been rectangular, though in at least one instance, referred to above, the circular form has been found. As to whether there were internal divisions in the huts no evidence has yet been found, though it seems certain they were thatched with straw or reeds. "Every hut had its hearth, consisting of three or four large slabs of stone; and it is probable from the almost universal prevalence of clay weights for weaving, that most, if not all, of them were furnished with a loom."

Such was, as far as can be gathered from the mine of information contained in Dr. Keller's volumes, the nature of these curious structures belonging to a remote age and a primitive people. But that the builders of these dwellings were considerably advanced beyond the lowest stage of civilisation is evident, not only from the structures themselves, but from the many articles found in connection with them, and which are so copiously figured in Dr. Keller's second volume. Implements, weapons, and ornaments, mostly in stone, but not infrequently in bronze and even in iron, have been found, of elaborate and finished structure. Beautifully wrought and ornamented textures, showing considerable skill not only in weaving, but in embroidery. Fishing-nets, fish-hooks, and boats, these lake-dwellers had, domestic animals and agricultural implements, all showing that, whoever they were, they were well on the way to a fairly high civilisation; they were fishers, hunters, shepherds and agriculturists, and to no small extent manufacturers. "The endeavours of the settlers to live together in permanent abodes and in a sociable manner, is a positive proof that they had long known the advantages of a settled mode of life, such as applies to the lake-dwellings, and that we have to look upon them not as wandering pastoral tribes, still less as a mere hunting and fishing people. A settled union of a great number of men in the same place, and of hundreds of families in the neighbouring bays, would never have taken place if there had not been a regular supply of provisions at all times of the year, and some beginning of social order."

To all interested in the progress of our race, the two fine volumes of Dr. Keller and Mr. Lee are well worthy careful study; they enable the student to put together with wonderful fulness a picture of a form of society that must have had an early beginning, and the dwellings, and implements, and manners and customs of which are full of interest. Considerable light is thrown on the subject of Dr. Keller's work by what we know of existing pile-dwellings in various parts of the world, not the least interesting of which are those found in Lake Mohyra, in Central Africa, by Commander Cameron.

OUR BOOK SHELF

Annual Record of Science and Industry for 1877. Edited by Spencer F. Baird. (New York: Harper Brothers. London: Trübner. 1878.)

THE high opinion which we have previously expressed concerning this excellent annual is sustained by the present volume, which, however, is smaller than its predecessors, owing to a change that has been made in its character. Hitherto the "Annual Record" has consisted of two distinct parts, a summary of scientific progress made during the year, and a series of abstracts of the more important papers and articles in the scientific journals. This dual character it has been found impossible to sustain, owing to the rapid increase in the number of scientific papers, and also probably to the larger range taken in by the contributors: hence the abstracts have been abolished and the summary alone retained. The change is a useful one, placing more space at the disposal of the editor and embarrassing the reader less. At the same time we regret the absence of references to

the papers themselves, which might be added as foot-notes, or incorporated in the text; and perhaps more distinction might be drawn between the longer researches, or more valuable memoirs of the year, and mere passing scientific observations. However, it is easier to criticise than to compile a work like the one before us. Our readers will form some idea of the comprehensive nature of this "annual record" by the following summary of its table of contents:—Astronomy, together with reports of the American observatories, contributed by Mr. Holden, of the United States Naval Observatory, Washington. Physics of the globe, followed by general physics, written by Prof. Barber, who also contributes the next section on chemistry. Mineralogy by Dr. Dana, and geology by Dr. Sterry Hunt. Hydrography and geography follow, the geography of North America being specially full. Microscopy, anthropology, zoology, and botany are contributed by able men in each department. Agriculture, engineering, technology, and industrial statistics are less full, and some of the abstracts given in technology would, we think, have found a better place under the head of physics, such, for example, as the telephone, phonograph, &c.

The observatory reports are a feature of the present volume, information being given concerning the *personnel* of each observatory, its principal instruments, the subjects of special observation during the past year, and those to be taken up during the coming year, and lastly the principal publications emanating from each observatory during the past year.

The bibliography at the end of the annual, giving the list of works on science published during 1877, seems most thoroughly and ably done, and so also is the index to the whole volume, and the concise and useful necrology of scientific workers. W. F. B.

Choice and Chance. An Elementary Treatise on Permutations, Combinations, and Probability. With 300 exercises. By W. A. Whitworth, M.A. Third edition, revised and enlarged. (Deighton, Bell and Co., Cambridge.)

WE have all three editions before us, and so are able to mark the growth of this work, which has been very considerable. The number of pages in the last edition is ten less than that of the second edition, but the volume is much thicker, and much of the matter is in smaller type. The work had already attained the position of a standard one on the subjects of which it treats, and it maintains and even improves its position in the present edition. Here, even in the elementary parts are to be found many propositions of great utility which are not to be met with, so far as we know, in any form elsewhere. We do not mean to say that they are not known to mathematicians, but writers have not introduced them into the text-books. Besides chapters on Permutations and Combinations, we have a chapter on *Distribution*, that is the separation of a series of elements into a series of classes, and one on *Derangements* (if a series of elements have been arranged, or if they have a proper order of their own, and we place them in some other order, we *derange* them). Under the head of *chance* we have a full treatment of that part of Probability which usually finds a place in algebraical treatises. Remarks "On the Disadvantages of Gambling," which formed an appendix to the last edition, here forms part of a chapter which also has a few paragraphs to show that insurance is the reverse of gambling, and discusses the effect of the repetition first of a fair wager, secondly of a wager at odds, thirdly of a fair wager on a scale proportioned to the speculator's means, the general case of a lottery with prizes of different value, and closes with a fairly exhaustive account of the Petersburg Problem. The novelty of this edition is a chapter on the geometrical representation of chances. We shall hope to see this chapter considerably enlarged in a future edition. The whole treatment may be said to assume nothing but what a well-primed algebraical student should be able to master. What is much wanted is a general treatise on the subject of Probability for English students. Mr. Todhunter's history of the theory down to the time of Laplace is a most interesting and able one, but it does not fill up the gap. In this branch, as in many others, we are dependent upon French writers, and still must have recourse to the works of Laplace, Poisson, and Liagre.

Pine Plantations on the Sand-Wastes of France. Compiled by John Croumbie Brown, LL.D., &c., &c. (Edinburgh: Oliver and Boyd. London: Simpkin Marshall and Co., 1878.)

THE subject of the reclamation of sand-wastes by the planting of coniferous trees or of grasses, shrubs, or other plants is one always of much importance. The extension of pine plantations has a two-fold interest over and above the primary cause of planting, namely, that arising from the general improvement in the appearance of the country, as the plants make growth and develop themselves into goodly forms, and that which is more utilitarian, but withal equally important—in the production of timber. Anything that can be done towards reducing the desolation of these French sand-wastes is a point gained not only, as Dr. Brown points out, for the benefit of France herself, but as indicating that what has been accomplished there may also legitimately be expected elsewhere, "not necessarily by the same means, but by means as appropriate, if they can be discovered." As will be seen from the title, the book does not claim originality, it professes to be a compilation, and the copious extracts, with the usual inverted commas, extending often over continuous pages makes this announcement unnecessary. Nevertheless a good work has been done in bringing together in a convenient form a great deal of valuable matter, scattered about in various books inaccessible for the most part to readers for whom the present work is intended, and amongst whom it will, no doubt, chiefly circulate; containing as it does detailed information on every branch of coniferous culture, from a consideration of the soils most suitable to satisfactory culture, to the collecting of the resin, and other economic products, and the diseases and injurious influences to which the plants are subject.

From the range of country under consideration, it will be understood that the pines treated of are limited to very few species, such as *Pinus sylvestris*, *P. maritima*, and *P. pinaster*. J. R. J.

La Morfologia vegetale. Esposta da T. Caruel. (Pisa, 1878.)

A NEW text-book of vegetable morphology, characterised by freshness both in the mode of treatment and in the illustrations, is an acquisition to botanical literature, even though written in a language which is unfortunately not familiar to most English readers. Prof. Caruel starts with the primary classification of all vegetable structures into the thallus, which displays no external differentiation, and the cormus, consisting of a central stipes (caulome), to which are attached appendages (phyllomes) more or less differing from the stipes. Under the head of the thallus he then discusses propaguli (of Muscineæ), conidia, sporidia (including zoospores), sporules (or spores, properly so-called), the pollen, and phytozoa (or spermatozoids). The general description of the cormus leads to an account of the various special forms which it assumes, viz., to the morphology of flowering plants and vascular cryptogams; and to the various modes of the reproduction of cormophytes by a process of impregnation, that is, the union of the contents of two dissimilar cells. Finally, Prof. Caruel discusses the various subjects connected with the genesis of species, and concludes with the